

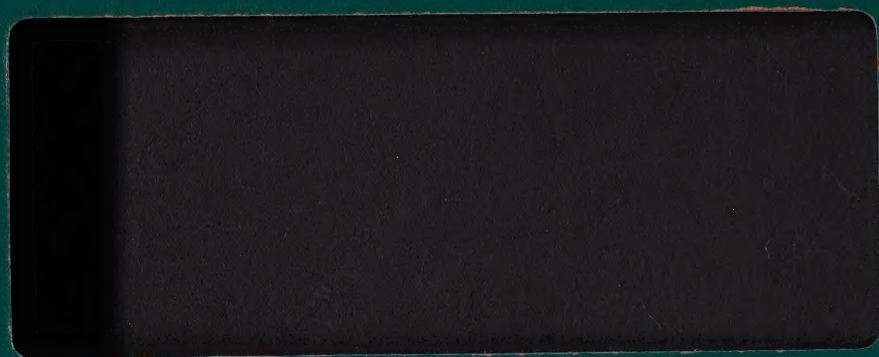
134

OPERATING AND MAINTENANCE
MANUAL

WESTERN ELECTRIC KS-15586 OSCILLOSCOPE
(Du Mont Type 2577)

DUMONT

ALLEN B. DUMONT LABORATORIES, INC.
1500 MAIN AVE., CLIFTON, N. J.



OPERATING AND MAINTENANCE
MANUAL

WESTERN ELECTRIC KS-15586 OSCILLOSCOPE
(Du Mont Type 2577)

ALLEN B. DU MONT LABORATORIES, INC.

Instrument Division

1500 Main Avenue

Clifton, New Jersey

1908

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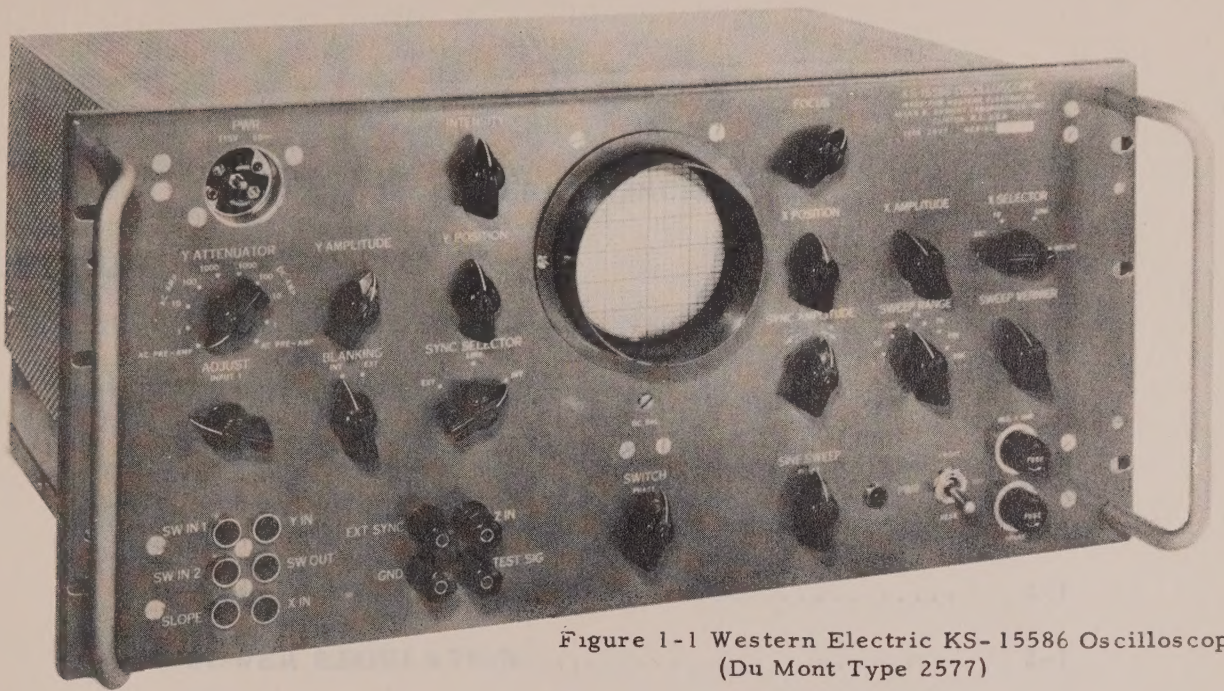


Figure 1-1 Western Electric KS-15586 Oscilloscope
(Du Mont Type 2577)



Figure 1-2 Western Electric KS-15586 Oscilloscope
in carrying case

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SECTION I

GENERAL DESCRIPTION

1. PURPOSE AND APPLICATION

The Western Electric KS-15586 Oscilloscope (Du Mont Type 2577) is intended for making transmission measurements on the TD-2 Radio System. Incorporated in the oscilloscope is a 30-cycle switch to give a simultaneous display of a reference trace and a signal trace to determine transmission characteristics.

2. PHYSICAL DESCRIPTION

Figure 1-1 shows an over-all view of the KS-15586 Oscilloscope which employs a Type 3RP1A Cathode-ray Tube. The instrument is supplied with a dust cover and a bottom plate primarily designed to protect personnel from dangerous potentials within the unit. Although designed primarily for standard relay rack or cabinet mounting, it may be installed in a portable carrying case of standard test set construction. Dimensions of the carrying case, exclusive of handle and catches, are 19-1/2" wide x 15-1/8" deep x 9-1/4" high. Approximate weight of the unit including carrying case is 40 pounds. The front panel is 19" wide x 8-3/4" high and the chassis depth is approximately 11". See Figure 1-2 for a view of the KS-15586 installed in its carrying case.

3. ELECTRICAL CIRCUITS

The KS-15586 Oscilloscope consists of a cathode-ray tube, X- and Y-axis amplifiers, a sweep generator, a 60-cycle blanking circuit and a 30-cycle counter circuit together with the necessary power supplies. The block diagram, Figure 1-3, shows the interrelation of these various circuits. For a list of general performance characteristics, see Table 1-1. Typical amplitude-frequency response curves for the Y- and X-axis amplifiers are shown in Figures 1-4 and 1-5 respectively.

Theory of operation of the various circuits will be found in Section III.

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the study and the objectives of the research. It also provides a brief overview of the methodology used in the study.

2. The second part of the report is a detailed description of the study area. It provides information about the location of the study area, the population of the study area, and the characteristics of the study area. It also discusses the data sources used in the study.

3. The third part of the report is a discussion of the results of the study. It presents the findings of the study and discusses the implications of the findings. It also provides a conclusion to the study.

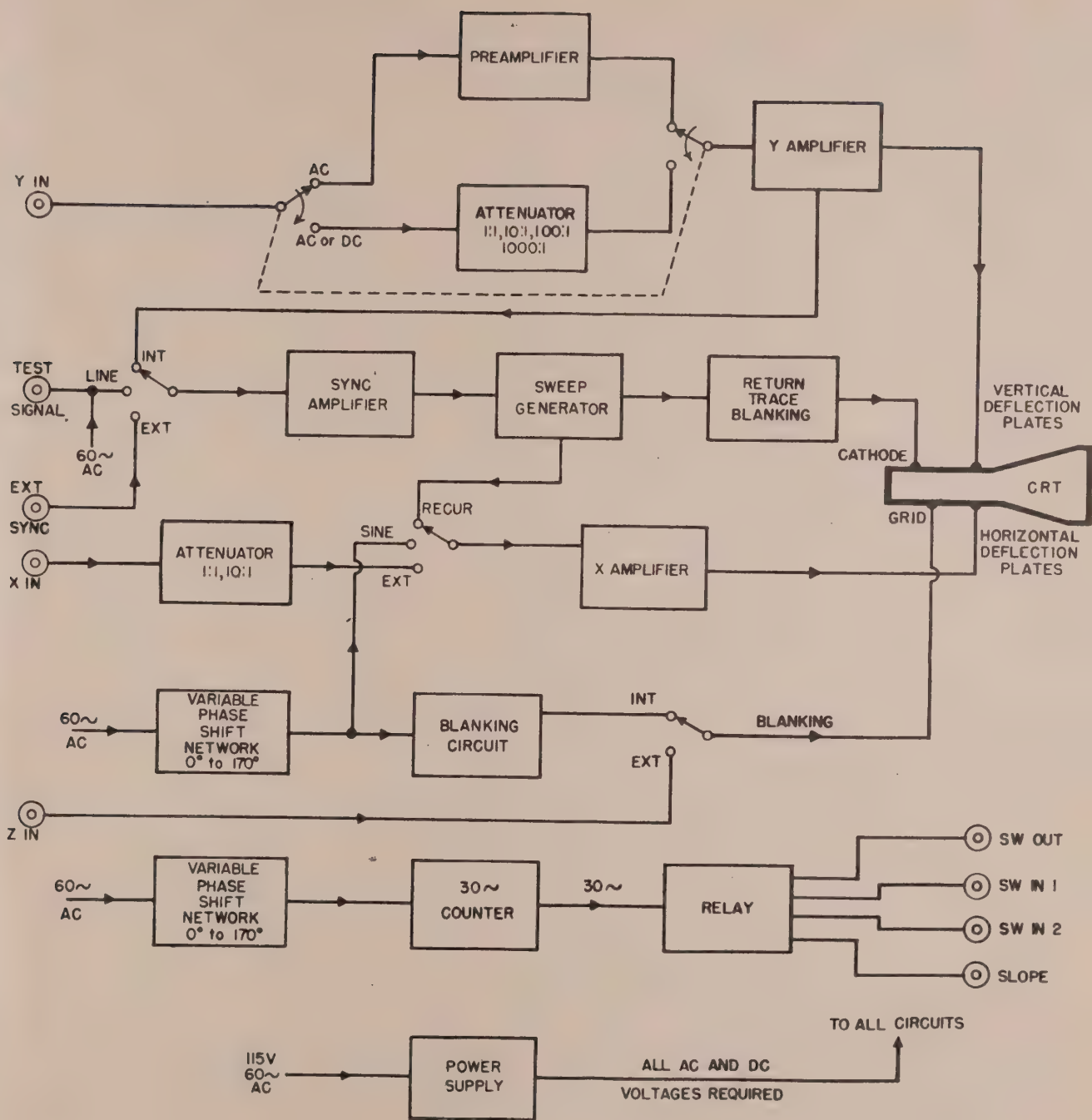


Figure 1-3 - Block Diagram of KS-15586 Oscilloscope

TABLE 1-1

PERFORMANCE SPECIFICATIONS

CATHODE-RAY TUBE

Type 3RP1A
 Accelerating Potential +1600 V dc

Y AXIS

Deflection Factor

Through Preamplifier - (for a-c inputs only) ... 1.25 rms mV/in
 Direct to Y amplifier - (on ac) 10 rms mV/in
 (No attenuation)
 (on dc) 28 dc mV/in

Frequency Response	D-C Amplifier	A-C Amplifier	A-C Preamplifier
Not more than 25% down	100 kc	100 kc	50 kc
Not more than 63% down	300 kc	300 kc	150 kc
30-cycle Square Wave	Good	<2-1/2% Tilt	<2-1/2% Tilt

Maximum Input Potential 100 V (dc + peak ac)

Attenuation By factors of 1, 10, 100, and 1000 through
 use of frequency-compensated voltage
 divider.

Input Impedance

To Preamplifier 2.2 meg, 50 μ f
 Direct to Y amplifier (ac or dc) 2.2 meg, 65 μ f

X AXIS

Deflection Factor (a-c inputs only) 0.5 V rms/in

Frequency Response

Not more than 30% down 100 kc
 Not more than 60% down 300 kc
 30-cycle Square Wave <5% Tilt

Maximum Input Potential 100 V (dc + peak ac)

Attenuation By factors of 1 and 10 through use of fre-
 quency-compensated voltage divider

Input Impedance 2.2 meg, 85 μ f

TABLE 1-1 (CONTINUED)

LINEAR TIME BASE

Recurrent Sweep

Frequency 2 cps to 30 kc
 Expansion To 6 times full screen
 Positioning .. Such that any portion of the expanded sweep may
 be examined on screen.
 Writing Rate .. Approximately 0.75 in. per microsecond max. at
 30 kc with full screen expansion.

BLANKING

Internal From 60-cycle pulse shaping circuit
 External A-C signal applied to Z IN terminal
 Input Impedance 2.2 meg, 300 μ f
 Sensitivity 5 to 50 volts peak to blank the beam depending
 on INTENSITY setting.

TEST SIGNAL

Frequency and Waveshape Same as power line
 Amplitude Approximately 3 rms V
 Availability At TEST SIGNAL jack on front panel

POSITIONING

The d-c positioning system permits the observation of any portion of
 the signal applied to either X or Y amplifiers under condition of full
 expansion to approximately six times full screen diameter.

POWER SUPPLY

Input Potential 115 rms V $\pm$ 10%
 Frequency 50-60 cps
 Power Consumption 100 watts
 Fuse Protection 1 amp

TUBE COMPLEMENT

1 - 2X2A	1 - 3TK2	1 - 6Q5G	4 - 12AU7
1 - 3RP1A	1 - 5V4G	8 - 12AT7	1 - 0A2
			1 - 0B2

2. It is essential to ensure that all data is entered correctly and consistently.

3. The second part of the document outlines the procedures for data collection.

4. This section describes the methods used to gather information from various sources.

5. The third part of the document details the analysis of the collected data.

6. This section explains how the data is processed and interpreted to draw conclusions.

7. The fourth part of the document discusses the results of the study.

8. This section presents the findings and discusses their implications for future research.

9. The fifth part of the document concludes the study and provides a summary of the key points.

10. Finally, the document includes a list of references and a bibliography.

11. The references are listed in alphabetical order and include all sources cited in the text.

12. The bibliography is located at the end of the document and provides a comprehensive list of all references.

13. The document is formatted according to the standards set by the journal.

14. The title page is located at the top of the document and includes the title, author, and date.

15. The abstract is located below the title page and provides a brief summary of the study.

16. The introduction is located at the beginning of the main text and provides background information.

17. The methods section is located in the middle of the main text and describes the procedures used.

18. The results section is located in the middle of the main text and presents the findings.

19. The discussion section is located in the middle of the main text and discusses the implications.

20. The conclusion is located at the end of the main text and provides a summary of the study.

21. The references are located at the end of the document and include all sources cited.

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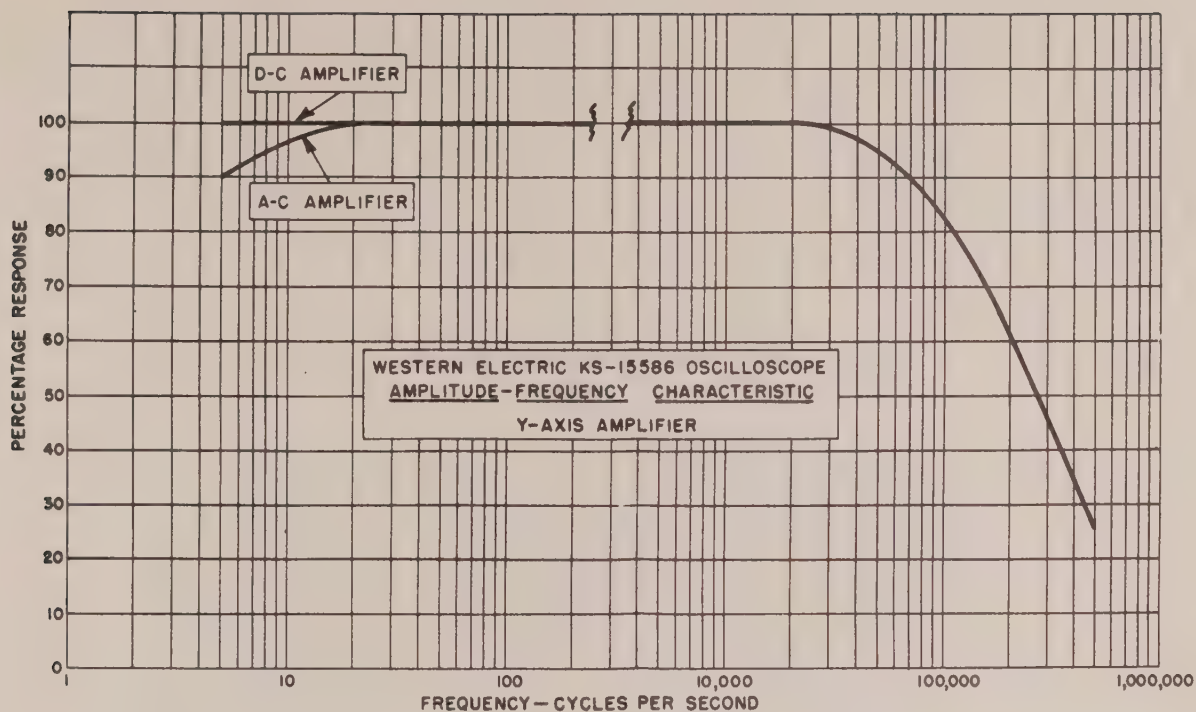


FIGURE 1-4

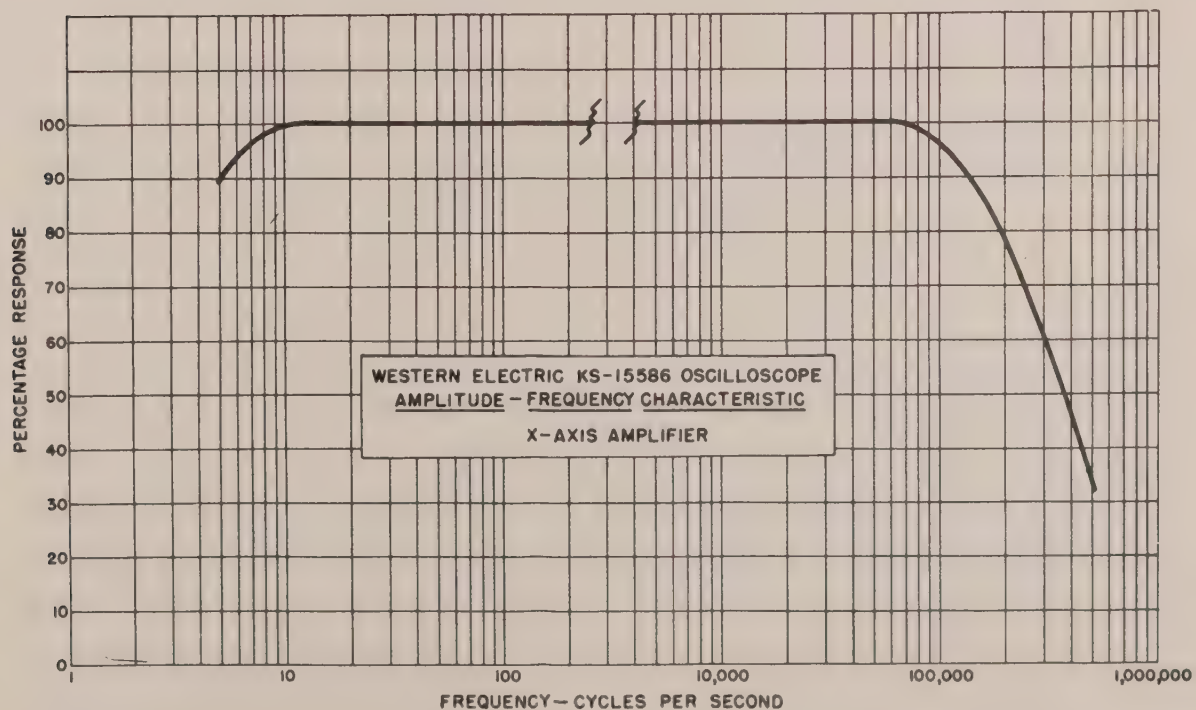


FIGURE 1-5

SECTION II

OPERATING INSTRUCTIONS

WARNING

THIS OSCILLOSCOPE EMPLOYS HIGH VOLTAGES WHICH MAY BE DANGEROUS TO LIFE. OBSERVE SAFETY PRECAUTIONS TO AVOID CONTACT WITH HIGH-VOLTAGE POINTS IN THE CIRCUIT. DO NOT CHANGE TUBES WITH THE POWER ON. TO AVOID SHOCK AND SEVERE BURNS, ALWAYS REMOVE THE POWER CORD FROM THE LINE OUTLET AND DISCHARGE CAPACITORS PRIOR TO WORKING INSIDE THE INSTRUMENT. NEVER MAKE ADJUSTMENTS WITHIN THE INSTRUMENT WITH THE POWER ON WITHOUT THE PRESENCE OF ANOTHER PERSON CAPABLE OF RENDERING FIRST AID IN CASE OF EMERGENCY.

1. PLACEMENT OF EQUIPMENT

The oscilloscope should be placed so as to avoid operation in strong fields such as are found near transmitters, transformers, power-generating equipment, etc., which might introduce spurious deflections.

2. POWER REGULATION

The KS-15586 Oscilloscope is designed to operate at a power-line potential of 115 volts rms at a frequency of 50 to 60 cycles per second. Steady variations of $\pm 10\%$ from the normal line voltage will cause little change in the operation of the instrument. Erratic operation may result from greater changes than this, however. Where power-line voltage variations are excessive, the use of a ~~constant-voltage~~ transformer placed in the power line leading to the instrument is recommended. Where such a regulator is used, it should be kept well away from the oscilloscope to avoid spurious deflections.

3. OPERATION OF CONTROLS

The operator is referred to the table on Operating Controls and Terminals (Table 2-1) which lists the function of each front-panel terminal and control

1. The first part of the report is a general
description of the project and its objectives.
2. The second part is a detailed description of the
methodology used in the study.
3. The third part is a description of the results
obtained from the study.
4. The fourth part is a discussion of the results
and their implications.
5. The fifth part is a conclusion and a summary
of the findings.

The results of the study show that the
methodology used is effective in achieving the
objectives of the project.

The findings of the study are consistent with
the previous research in this area. The results
also show that the methodology used is effective
in achieving the objectives of the project.

shown in Figure 2-1.

a. OPERATION FAMILIARIZATION PROCEDURE

For operating personnel generally unfamiliar with the operation of cathode-ray oscilloscopes, the following familiarization procedure is suggested:

Step 1. Set the front-panel controls as follows:

Y POSITION	--center of range
X POSITION	--center of range
INTENSITY	--fully counterclockwise
PWR	--center (off)
FOCUS	--center of range
Y ATTENUATOR	--AC 1000
Y AMPLITUDE	--fully counterclockwise
X SELECTOR	--RECUR
X AMPLITUDE	--center of range
SWEEP RANGE	--between 10 and 120
SWEEP VERNIER	--fully clockwise
SYNC AMPLITUDE	--center of range
SYNC SELECTOR	--EXT

Step 2. Apply 115 volts, 50-60 cycles ac to the PWR jack on the front or rear.

Step 3. Turn power on by placing the PWR switch toggle in FRONT or REAR position as determined by location of line cord.

Step 4. Allow 30 seconds for the instrument to warm up.

Step 5. Advance the INTENSITY control until a trace is visible on the cathode-ray tube screen. If no trace becomes visible, rotate the Y POSITION control in either direction until the trace appears.

WARNING

NEVER ADVANCE THE INTENSITY CONTROL TO A POSITION WHICH CAUSES AN EXCESSIVELY BRIGHT SPOT OR TRACE TO APPEAR ON THE SCREEN. SUCH A CONDITION MAY RESULT IN SCREEN BURNING AND DECREASE THE LIFE OF THE CATHODE-RAY TUBE, PARTICULARLY IF PERMITTED TO REMAIN FOR ANY LENGTH OF TIME.

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

2600

2700

2800

2900

3000

3100

3200

3300

3400

Step 6. Rotate the FOCUS control as required to the position where the trace is clear and sharp (least "fuzzy").

NOTE

The action of the INTENSITY and FOCUS controls are inherently dependent on each other. Therefore, it may be necessary, whenever varying one control, to adjust the other control to obtain the best definition of the trace.

Step 7. Rotate the Y POSITION control counterclockwise (DOWN) and clockwise (UP). Observe that the trace moves down and then up as the control is turned. Center the trace in the vertical plane.

Step 8. Rotate the X AMPLITUDE control counterclockwise and observe decrease in amplitude of the sweep trace. Set the sweep amplitude for about 2 inches of deflection.

Step 9. Rotate the X POSITION control, first counterclockwise (left), and then clockwise (right). Observe that the trace moves left and then right as the control is turned. Center the trace in the horizontal plane.

Step 10. Apply a signal (The output from the TEST SIG binding post may be used) to the Y IN jack. Adjust the Y ATTENUATOR and Y AMPLITUDE control for approximately two inches of vertical deflection.

Step 11. Set the SWEEP RANGE and rotate the SWEEP VERNIER until one or more cycles of the wave can be identified on the screen. Stop the drifting of this wave as nearly as possible with the SWEEP VERNIER control.

Step 12. Set SYNC SELECTOR switch to INT and turn the SYNC AMPLITUDE control clockwise (to the + side) until the pattern "locks in." Notice that the positive half cycle of the signal is at the left side of the trace.

Step 13. Turn the SYNC AMPLITUDE control counterclockwise (to the - side) until the pattern "locks in." Notice that the negative half cycle is now at the left side of the trace. This illustrates the difference between synchronizing on positive and negative signals.

Step 14. Synchronize the sweep to produce about six cycles of the signal on the screen. Observe how any one of these cycles may be expanded to approximately full-screen diameter by means of the X AMPLITUDE and X POSITION controls.

Step 15. Readjust the SWEEP RANGE, SWEEP VERNIER and X POSITION controls to obtain two sine-wave cycles centered on the screen.

Set BLANKING switch at EXT. Connect a test lead from the TEST SIG binding post and the Z IN binding post. (This applies a 60-cycle sine-wave signal to the Z IN post). Keeping the INTENSITY low, note how the negative portion of the wave is blanked out.

Step 16. Set the BLANKING switch at INT. Note how the blanked portion varies with the setting of the SINE SWEEP PHASE control. This control provides 170-degree phasing.

TABLE 2-1

OPERATING CONTROLS AND TERMINALS

Name of Control	Circuit Symbol	Component Description	Function
PWR	J502	Connector, 3-prong, male	Power-line input connector (Another input connector is located on the rear of the chassis).
INTENSITY	R504	50K potentiometer	Varies the voltage on the cathode of the cathode-ray tube thus varying the intensity of the trace.
FOCUS	R506	100K potentiometer	Varies the voltage on the focusing electrode of the cathode-ray tube and thus adjusts the beam for sharp focus.
Y ATTENUATOR	S101	Switch, 3 pole, 10 position	Selects the appropriate amplifier connection for a-c or d-c input signals at Y IN jack. Selects attenuation by factors of 10, 100, or 1000 and connects preamplifier in circuit for low amplitude a-c inputs.
Y AMPLITUDE	R118	25K potentiometer	Controls the amplitude of the vertical deflection.
Y POSITION	R123	1K potentiometer	Changes the vertical position of the trace.
X POSITION	R217	10K potentiometer	Changes the horizontal position of the trace.
X AMPLITUDE	R214	25K potentiometer	Controls the amplitude of the horizontal deflection.
X SELECTOR	S201	Switch, 2 pole, 4 position	Selects recurrent internal linear sweep, internal sine-wave sweep, or 1:1 or 10:1 attenuation of external signals.

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TABLE 2-1 (CONTINUED)

Name of Control	Circuit Symbol	Component Description	Function
ADJUST INPUT 1	R401	1K potentio-meter	Adjusts amplitude of signal applied to relay from SW IN 1 input jack.
BLANKING	S202	Switch, 1 pole, 2 position	Selects either an internal 60-cycle blanking pulse or an external blanking signal applied to the Z IN terminal.
SYNC SELECTOR	S301	Switch, 1 pole, 3 position	Selects synchronizing signals from the vertical channel, a 60-cycle sine-wave source or from the EXT SYNC terminal.
DC BAL	R115	100 ohm potentiometer	Screwdriver adjustment to equalize the d-c voltages at the ends of the Y AMPLITUDE control to prevent change in position of the beam trace when varying Y AMPLITUDE.
SYNC AMPLITUDE	R310	200K potentiometer, center-tapped	Selects phase and varies amplitude of sync signal for proper sync of the sweep generator.
SWEEP RANGE	S302	Switch, 1 pole, 6 position	Varies sweep rate in six overlapping steps.
SWEEP VERNIER	R314	5 meg potentiometer	Provides continuous variation of sweep rate in conjunction with the SWEEP RANGE control.
SW IN 1	J402	Coaxial Jack	Provides for connection of an external signal through an amplitude control to one set of relay contacts on K401.
SW IN 2	J403	Coaxial Jack	Provides for direct connection of an external signal to one set of relay contacts on K401.

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TABLE 2-1 (CONTINUED)

Name of Control	Circuit Symbol	Component Description	Function
SLOPE	J404	Coaxial Jack	Provides for connection of an external signal through a fixed resistance attenuator to one set of relay contacts on K401.
Y IN	J101	Coaxial Jack	Provides for connection of an external signal for vertical deflection of the cathode-ray beam.
SW OUT	J401	Coaxial Jack	Provides for an output connection from relay K401.
X IN	J201	Coaxial Jack	Provides for connection of an external signal to the X amplifier for horizontal beam deflection.
EXT SYNC		Binding Post	Provides for connection of an external sync signal.
GND		Binding Post	Provides a terminal for connection of a ground lead.
Z IN		Binding Post	Provides for connection of an external blanking signal.
TEST SIGNAL		Binding Post	Provides a terminal at which a line-frequency sine wave output voltage of approximately 3 volts rms is available.
SWITCH PHASE	R404	50K potentiometer	Adjusts the relative phase of the a-c voltage to the 30-cycle counter circuit with respect to line voltage.
SINE SWEEP PHASE	R201	50K potentiometer	Adjusts the relative phase of the sine sweep voltage and internal blanking signal with respect to the line voltage.

TABLE 2-1 (CONTINUED)

Name of Control	Circuit Symbol	Component Description	Function
POWER	S501	Switch, 2 pole 3 position, toggle	To turn power on and off. Center position is OFF. FRONT position is selected for turning on power when line cord is attached at front panel; REAR position is se- lected when line cord is attached at rear.

SECTION III

THEORY OF OPERATION

1. GENERAL

The Western Electric KS-15586 Oscilloscope (Du Mont Type 2577) contains circuits which will be considered in the following order:

- a. Y amplifier
- b. X amplifier
- c. Sweep Generator
- d. Blanking Circuit
- e. 30-cycle Counter Circuit
- f. Power Supply
- g. Cathode-ray Tube Circuit

For a general understanding of the interrelated functioning of the various circuits, see the block diagram, Figure 1-3.

2. CIRCUIT THEORY

a. Y AMPLIFIER

The Type KS-15586 Oscilloscope contains a high-gain d-c vertical amplifier employing tubes V102, V103 and V104. At the input to this vertical amplifier, an attenuator is provided with high-frequency compensation to retain the high-frequency components of the signal while providing attenuation ratios of 1, 10, 100 and 1000 to both a-c and d-c inputs. An a-c preamplifier stage, V101, provides additional gain when required. No attenuation is possible when using this preamplifier except that obtained by using the Y AMPLITUDE control, R118. For information on input sensitivity, see Table 1-1.

Direct coupling is provided between all stages of the Y amplifier. The balanced arrangement results in a high degree of amplifier stability. The Y AMPLITUDE control, R118, follows the input stage, V102. Through the use of R118 in series with the Y AMPLITUDE control, any input signal large enough to cause distortion in the stages preceding this control will cause the beam to be deflected off screen even at minimum gain setting. This is a precautionary measure which prevents the operator from misinterpreting a wave that appears on the screen but is distorted within the oscilloscope.

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By switching in additional attenuation so that the pattern appears on screen, the distortion is eliminated.

The Y-amplifier input stage, V102, is connected as a cathode-coupled para-phase amplifier. A signal applied to the grid (pin 7) of V102 produces a wave of the same shape and polarity across the cathode-resistor, R114. Since grid (pin 2) of V102 is grounded this voltage across R114 is impressed between grid and cathode of the second half of V102. Thus, the input voltages to the two halves of V102 are nearly equal but of opposite polarity resulting in push-pull output from the circuit.

To prevent changes in beam position on the cathode-ray tube screen with variation in the setting of the Y AMPLITUDE control, R118, a d-c balance control is provided. The d-c potentials at the ends of the Y AMPLITUDE control must be maintained equal. This is done by balancing the two halves of V102 through adjustment of the DC BAL control, R115. For convenience, the DC BAL adjustment is accessible from the front panel. For this balance control to work properly, the BIAS control, R122, located on the chassis, must be properly adjusted so that V103 draws no grid current. See Section IV for instructions on proper adjustment of the BIAS control.

Potentiometer R123 controls the d-c balance of V103 and thus controls the vertical positioning of the beam. The positioning range is such that even with a vertical deflection approximately six times full-screen diameter, any three-inch portion of the vertical deflection may be centered on the screen.

The BIAS potentiometer, R122, is factory adjusted to properly set the bias on V103. The proper adjustment is important to minimize variations in gain or in d-c balance with variations in line voltage. R126 is a similar screw-driver adjustment potentiometer in the cathode circuit of V104 which is factory set so that V104 will provide as large an output as possible without distortion. C111, C112, C113 and C114 provide feedback with resultant improvement in high-frequency response.

b. X AMPLIFIER

The X amplifier is direct coupled and similar to the Y amplifier except for the first stage, which is connected as a cathode follower. The gain is somewhat less in the X amplifier than in the Y amplifier. An input attenuator permits voltage attenuation of 10:1 when required. Since the cathode-follower stage, V102, precedes the X AMPLITUDE control, R214, resistor R215 has been placed in series with the control to prevent reduction of amplification of the X amplifier to zero. The reason for this, as in the case of the Y amplifier, is to cause part of the wave to deflect off the screen when input signals are insufficiently attenuated to prevent distortion within the oscilloscope.

R217 is the X POSITION control. This functions in the same manner as the Y POSITION control, R123, and permits examination of any portion of a

4. The fourth part of the document discusses the application of the findings to the real world. It describes how the results of the analysis can be used to inform decision-making and to develop policies and programs. This section also discusses the importance of communicating the findings to the relevant stakeholders and of ensuring that the results are used effectively.

5. The final part of the document provides a summary of the key findings and conclusions. It reiterates the importance of maintaining accurate records and of using appropriate statistical methods to analyze the data. It also discusses the implications of the findings for the future of the financial system and for the development of policies and programs.

horizontal trace expanded to six times full-screen diameter. By unbalancing the plate currents to the two halves of V203, a d-c voltage unbalance occurs at the plates (pins 1 and 6) of V203. This unbalance is amplified by V204 with resultant displacement of the trace on the cathode-ray screen. The X LINE - ARITY control, R223, is adjusted at the factory and is located on the chassis. Its function is the same as the corresponding control in the Y-amplifier circuit. It adjusts the bias on V204 for maximum undistorted signal output. See Section IV for details on adjustment.

c. SWEEP GENERATOR

The sawtooth sweep voltage is generated in the gas triode circuit of V302, a type 6Q5G. The cathode of this tube is heated and emits electrons as in the ordinary high vacuum triode. The inert gas in the tube breaks down when the voltage between the cathode and plate reaches a certain value, depending upon the bias potential applied, resulting in a very low impedance from plate to cathode. In this sweep circuit a fixed bias is applied to the cathode of the gas triode through the divider network consisting of resistors, R316 and R313.

One of the capacitors (C307 to C313) is selected by S302 and connected from plate to cathode of the tube. When the circuit is first turned on, the capacitor charges up from the plate supply through resistors R314, R315 and R313 until the voltage across it reaches the ignition (breakdown) voltage of the tube. At this point the tube "fires," effectively short circuiting the capacitor and causing its voltage to drop quickly to the extinction potential of the gas triode (approx. 19 volts). When the voltage across the tube drops to its extinction potential, it stops conducting. The capacitor thereupon starts to charge again and the cycle of events is repeated. As this action continues, a periodic sawtooth waveform results at the plate of V302. The frequency of this wave depends upon the time required to charge the capacitor through the series resistors to the ignition potential of the tube and is dependent upon the time constant of the circuit consisting of R313, R315 and R314 together with the selected sweep capacitor. The seven capacitors provide a continuous range of sweep frequencies from 2 cycles to 30,000 cycles per second. A vernier adjustment on each range is provided by the SWEEP VERNIER potentiometer, R314.

The sweep must be attenuated before application to the X amplifier; otherwise saturation would occur in the cathode-follower input stage. The plate of the thyratron, however, must not be loaded by an attenuator as this would distort the low-frequency sweeps. Therefore, the sweep is direct coupled to a cathode-follower stage (one-half of V303), the output from which is applied through a frequency-compensated voltage divider to the X amplifier when the X SELECTOR switch is in the RECUR position. After passing through the X amplifier, which provides for positioning and amplification of the sweep trace on the screen of the cathode-ray tube, the sweep is applied to the horizontal deflection plates.

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3.

4. The third part of the report is a discussion of the results of the study.

5. The fourth part of the report is a conclusion and a list of references.

6. The fifth part of the report is a summary of the findings of the study.

The sweep generator may be synchronized from the vertical amplifier, from an external source, or from the power line. The X SELECTOR switch, S301, mounted on the front panel controls this selection. Synchronizing action is such that when a positive synchronizing voltage is applied to the grid of V 302, the gas triode, making it less negative, the firing potential of the tube is lowered causing it to fire at a lower plate potential than when no synchronizing signal is applied. Thus, the sweep generator is locked in step at the synchronizing signal frequency or an integral submultiple thereof. The necessary positive synchronizing voltage at the grid of the thyatron may be obtained from either a positive or negative input signal to the first sync amplifier, V301-A. This is a phase-selector stage which enables the operator to select phase and amplitude of synchronizing voltage from the plate or the cathode through the use of the 200K center-tapped potentiometer, R310, connected as shown on the schematic. The output from this phase-selector stage is fed to a stage of amplification, V301-B, the output from which is applied to the grid of the thyatron through C305. The 1N34 germanium diode, connected as shown on the schematic, limits the synchronizing voltage applied to the grid of the gas triode. This diode prevents the grid of the gas triode from charging to an excessively high positive potential resulting in premature firing and a reduction of sweep amplitude accompanied by distortion of the sweep.

d. BLANKING CIRCUIT

For blanking portions of the trace on the screen, a 60-cycle blanking circuit is employed. 60-cycle a-c voltage from the heater supply is connected across the phase-shifting network, R201 and C201. Since the filament center tap is grounded an a-c voltage, which may be adjusted in phase over a range of approximately 170° through adjustment of the sine sweep-phase control, R201, will appear between the grid (pin 2) of V201 and ground. This voltage is amplified and clipped in the first half of V201 and further amplified and squared in the second half. Potentiometer R205, a factory adjustment control located on the chassis, varies the grid bias on the second half of V201, enabling the two halves of the square wave to be adjusted for equal width.

The 60-cycle square-wave output from the blanking circuit is applied through the blanking switch, S202, and C501 to the grid of the cathode-ray tube. Crystal rectifier CR501 acts as a clamp, effectively keeping the CRT grid from going more positive (or less negative) on the positive half of the square wave and prevents the beam trace from being intensified.

e. 30-CYCLE COUNTER CIRCUIT

The 30-cycle counter employs the same type of phase-shifting network used at the input to the blanking circuit. It consists of potentiometer R404 and capacitor C401 connected across the heater supply. This provides a variable phase voltage at the grid (pin 4) of V401. This 60-cycle voltage is amplified

1. The first part of the paper discusses the importance of understanding the underlying mechanisms of the observed phenomena. It highlights the need for a comprehensive approach that integrates various disciplines, including physics, chemistry, and biology, to fully grasp the complexity of the system under study.

2. The second part of the paper focuses on the experimental setup and the data collected. It describes the methods used to measure the various parameters and the challenges encountered during the data collection process. The results show a clear correlation between the measured quantities and the theoretical predictions.

3. The third part of the paper presents the theoretical model and the calculations performed. It details the assumptions made and the mathematical derivations used to predict the behavior of the system. The model is then compared with the experimental data, showing a good agreement between the two.

4. The fourth part of the paper discusses the implications of the findings and the potential applications of the results. It suggests that the developed model can be used to optimize the design of the system and to predict its performance under different conditions. The paper concludes by highlighting the need for further research to validate the model and to explore the underlying mechanisms in more detail.

5. The fifth part of the paper discusses the limitations of the current study and the directions for future research. It points out that the model is based on certain assumptions and that the experimental data is limited in scope. Future work should aim to refine the model and to collect more comprehensive data to improve the accuracy of the predictions.

6. The sixth part of the paper provides a summary of the key findings and the conclusions drawn from the study. It reiterates the importance of a multi-disciplinary approach and the need for continued research in this field. The paper ends with a statement of the authors' appreciation for the support and assistance provided during the course of the research.

through the two halves of V401 producing a 60-cycle output at the plate (pin 6) of about 220 volts peak-to-peak amplitude. This is applied through C403 to both grids of V402 which is connected as a bi-stable trigger circuit possessing two conditions of stable equilibrium. One condition is when the first half of V402 is conducting while the second half is cut off. The other condition is when the second half of V402 is conducting while the first half is cut off. The circuit will remain in one or the other of these two conditions with no change in plate, grid or cathode potential until some action occurs which causes the nonconducting tube to conduct. The tubes then alternate their functions.

When the first half of V202 is cut off, a negative signal applied to its grid will have no effect since the tube is already cut off; however, the same negative signal is applied to the grid of the second half of V402 and will cut off its plate current causing V402 to trigger to the other stable condition. Each negative half of the 60-cycle wave triggers the tube from one stable-equilibrium condition to the other. It thus takes two cycles of the input signal to produce one complete cycle in V402. This stage thus serves as a two-to-one counter circuit producing one output for every two inputs. The coil of a sensitive relay, K401, is connected between the plate circuits of the two halves of V402. As plate current alternately flows and is cut off at the 30 cycle rate, these 30-cycle pulsations are applied to the coil of the relay and cause it to vibrate at a 30-cycle rate. R419, a screwdriver adjustment potentiometer in the cathode circuit of V402, is initially adjusted at the factory to produce the proper bi-stable operating conditions. If R419 is improperly adjusted, this circuit will operate erratically or will not operate at all. The contacts on the relay are connected to jacks J401, J402, J403 and J404 located on the front panel, thus making possible various switching combinations.

f. POWER SUPPLY

Transformer T501 furnishes all voltages necessary for operation of the KS-15586 Oscilloscope. V503 is the rectifier in the 430-volt d-c supply and is connected in a full-wave rectifier circuit. Capacitors C507 and C508 together with inductor L501 provide filtering. A 150-volt regulated supply is obtained from the 430-volt source by use of dropping resistor R515 and voltage regulator tube V504, with C302 furnishing additional filtering. A similar circuit, composed of V505 and R516, connected across the +150-volt regulated output, furnishes +108 volts regulated for the preamplifier stage.

The high-voltage supply, which is half-wave rectified by V502 and filtered by the two-section filter consisting of C504, C505, C506, R510 and R511, furnishes -1260 volts dc.

g. CATHODE-RAY TUBE CIRCUIT

This instrument employs a Type 3RP1A Cathode-ray Tube. Heater and all d-c operating potentials are obtained from the power supply. The second

anode voltage is obtained from the junction of R514 and R513, a voltage divider connected across the +430-volt d-c supply. C503 is a bypass capacitor for this anode.

Proper grid, cathode and first-anode potentials are obtained from the voltage divider consisting of R503, R504, R505, R506, R507, R508 and R509 connected across the -1260-volt d-c supply source.

The intensity of the cathode-ray beam is adjusted by varying the CRT cathode potential at the arm of potentiometer R504, thus varying the grid-cathode potential (bias) of the CRT. Focusing is accomplished by adjustment of the potential on Anode No. 1 as obtained from the center arm of potentiometer R506. There is an optimum setting of the FOCUS control for each setting of the INTENSITY control, and adjustment of the INTENSITY control will normally require readjustment of the FOCUS.

SECTION IV

MAINTENANCE

1. GENERAL

A complete schematic diagram of the KS-15586 Oscilloscope will be found at the end of this section and will be found useful in analyzing and servicing the instrument. As an aid in ordering replacement parts, a complete manufacturer's electrical parts list is also provided.

WARNING !

THIS OSCILLOSCOPE EMPLOYS HIGH VOLTAGES WHICH MAY BE DANGEROUS TO LIFE. OBSERVE SAFETY PRECAUTIONS TO AVOID CONTACT WITH HIGH-VOLTAGE POINTS IN THE CIRCUIT. DO NOT CHANGE TUBES WITH THE POWER ON. TO AVOID SHOCK AND SEVERE BURNS, ALWAYS REMOVE THE POWER CORD FROM THE LINE OUTLET AND DISCHARGE CAPACITORS PRIOR TO WORKING INSIDE THE INSTRUMENT. NEVER MAKE ADJUSTMENTS WITHIN THE INSTRUMENT WITH THE POWER ON WITHOUT THE PRESENCE OF ANOTHER PERSON CAPABLE OF RENDERING FIRST AID IN CASE OF EMERGENCY.

2. CIRCUIT VOLTAGES AND WAVEFORMS

D-C voltages are shown on the schematic at critical points of the circuit to aid in locating trouble and servicing.

Waveforms, together with their approximate amplitudes, are shown on the schematic at critical points in the "Blanking Circuit" and the "30-cycle Counter Circuit."

It should be realized that the values of voltage shown on the schematic are nominal and that considerable variation may be experienced due to various line-voltage conditions and component tolerances. Generally a variation of $\pm 10\%$ is to be expected and as great a variation as 20% may not be uncommon. Judgment is often required to determine if a particular deviation is indicative of trouble.



TABLE 4-1

FACTORY ADJUSTMENTS*

Nomenclature	Circuit Designation	Description	Function
30 CYCLE FREQ	R419	50K potentiometer	Adjusts stability of 30-cycle counter circuit.
BLANK WIDTH	R205	1.0 Meg potentiometer	Adjusts width of 60-cycle internal blanking signal
BIAS	R122	50K potentiometer	Adjusts bias on second stage of Y amplifier for proper operation
Y LINEARITY	R126	50K potentiometer	Adjusts bias on final stage of Y amplifier for least distortion in vertical presentation with change in vertical position.
X LINEARITY	R223	50 K potentiometer	Adjusts bias on final stage of X amplifier for least distortion of horizontal presentation with change in horizontal position
X DC BAL	R212	2K potentiometer	Adjusts for equal voltage at ends of X AMPLITUDE control so that there will be no change in position of trace when X AMPLITUDE is varied.
(Y) DC BAL ¹	R115	100 ohm potentiometer	Adjusts for equal voltage at ends of Y AMPLITUDE control so that there will be no change in position of trace when Y AMPLITUDE is varied

*These controls are adjusted and locked (except (Y) DC BAL) during factory test of the instrument.

¹This control is located directly beneath the cathode-ray tube on the front panel and is adjusted by means of a screwdriver.

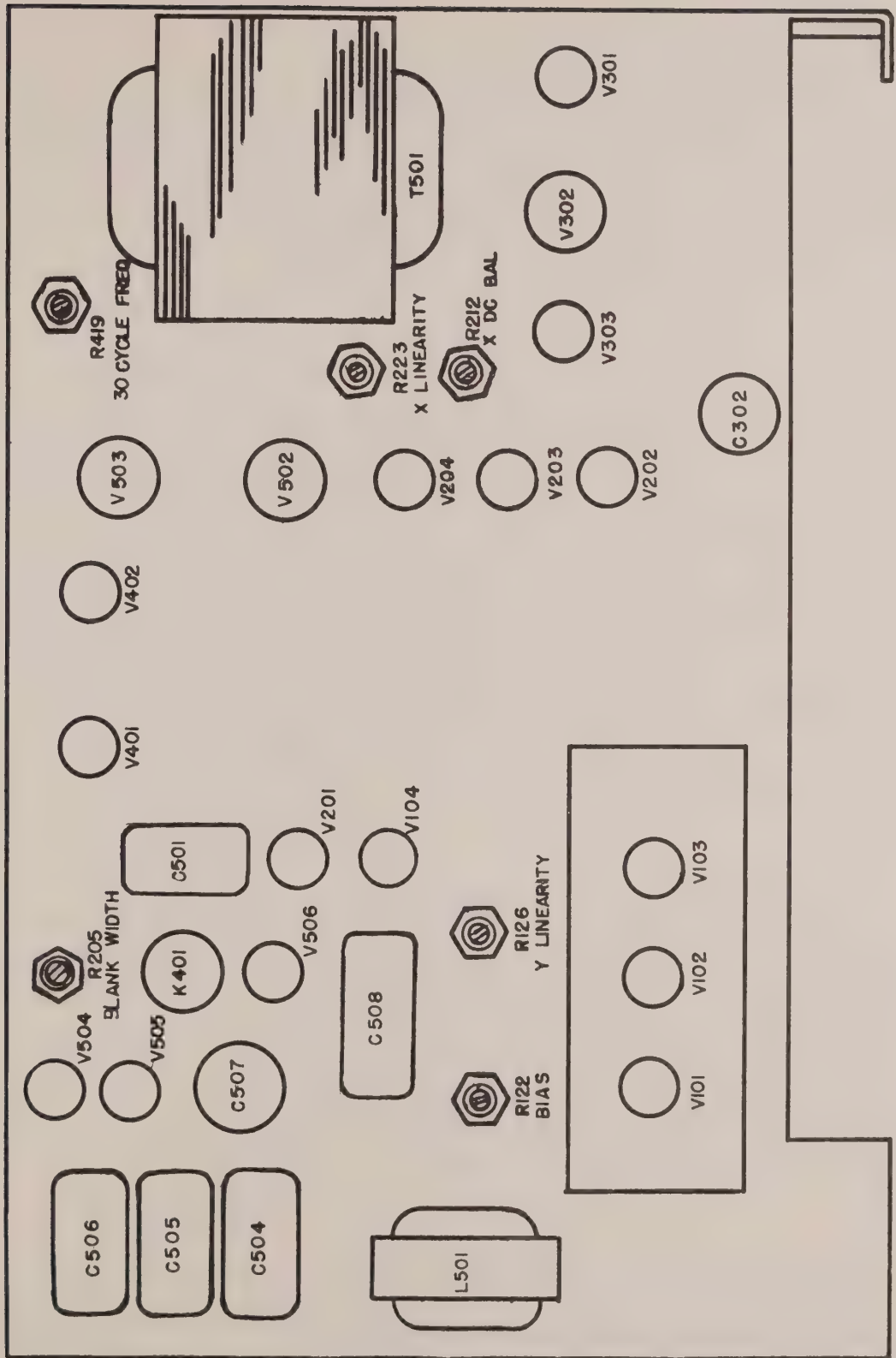


Figure 4-1 Top view of chassis, showing location of Factory Adjustments

FACTORY ADJUSTMENTS

Certain adjustments are provided behind the front panel of the instrument to facilitate the maintenance of top performance from the equipment when tubes are changed or when components must be replaced. Normally, these factory adjustments should not be touched unless replacement of components makes this necessary. Figure 4-1 shows the location of the factory adjustments as viewed from the top of the chassis. The various factory adjustment controls are listed in Table 4-1 under the nomenclature stamped on the chassis of the instrument. Also shown in the table are the symbol designations and control functions.

a. 30 CYCLE FREQ ADJUSTMENT

Set SYNC SELECTOR switch on LINE position, SWEEP RANGE on 1 and BLANKING switch on EXT. Connect a lead from the TEST SIG binding post to the Y IN jack. Set the X SELECTOR switch on RECUR, and adjust the X AMPLITUDE control for full-scale deflection. Set the Y ATTENUATOR on 100 (either AC or DC), and adjust the Y AMPLITUDE control for a convenient amount of vertical deflection. Now adjust the SWEEP VERNIER and SYNC AMPLITUDE controls so that two cycles of a sine wave are locked on the screen. Leaving all controls set in position, disconnect the lead from the TEST SIG post to the Y IN jack, and connect from the TEST SIG post to the SW IN 2 jack. Also connect a lead from the SW OUT jack to the Y IN jack. Without disturbing any front-panel control settings, loosen the lock nut on the 30 CYCLE FREQ adjustment at the rear of the chassis (See Figure 4-1), and adjust until one cycle of a sine wave is locked on the screen. After adjustment, tighten the lock nut being careful not to disturb the setting.

b. BLANK WIDTH ADJUSTMENT

Set the X SELECTOR switch at RECUR, the SYNC SELECTOR switch at LINE, the SWEEP RANGE switch at 1 and the BLANKING switch at INT. Set the Y AMPLITUDE control at minimum, and adjust the X AMPLITUDE control for full-scale horizontal deflection. Rotate the SWEEP VERNIER until a horizontal trace with three or four blanked portions appears on the screen; then turn up SYNC AMPLITUDE until the pattern is locked in. Loosen the lock nut on the BLANK WIDTH control at the rear of the chassis (See Figure 4-1), and adjust this control until the ratio of the widths of the blanked to unblanked portions of the trace becomes $1 \pm 5\%$. Tighten the lock nut again being careful not to disturb the setting.

c. BIAS ADJUSTMENT

For this adjustment a Variac or other means of varying the line voltage will be required. Allow the instrument to warm up for 15 minutes. The (Y) BIAS and (Y) DC BAL control adjustments are interrelated to a certain extent. If either control is far off adjustment, it may be impossible to properly adjust the other. When both controls are out of adjustment at the start,

loosen the lock nut on the BIAS control on the chassis (See Figure 4-1), and set the control to approximately the center of its rotation. Then adjust the DC BAL control (screwdriver adjustment under the cathode-ray tube on the front panel) until there is no change in vertical position when the Y AMPLITUDE control (also front panel) is turned from maximum to minimum.

A steady signal from an external source should now be connected to the Y IN jack, and the front panel controls should be adjusted in the usual manner to obtain a suitable deflection on the screen. The BIAS control should now be adjusted for minimum change in amplitude and position of the trace when the line voltage is varied over a range from 105 to 125 volts. Tighten the lock nut on this control being careful not to disturb the adjustment. It may be necessary to readjust the (Y) DC BAL control slightly after the BIAS control is properly set.

d. Y LINEARITY ADJUSTMENT

Connect a steady signal from an external source to the Y IN jack, and adjust the Y ATTENUATOR and Y AMPLITUDE controls to obtain approximately one-inch vertical deflection on the screen. Loosen the lock nut on the Y LINEARITY control on the chassis (See Figure 4-1). Move the image up and down on the screen with the Y POSITION control, while adjusting the Y LINEARITY control until there is no change in amplitude of the vertical deflection with beam movement. Tighten the lock nut being careful not to disturb the adjustment.

e. X LINEARITY ADJUSTMENT

Set the X LINEARITY control by the same procedure outlined above for the Y LINEARITY control using the corresponding X-axis controls--X SELECTOR, X AMPLITUDE and X POSITION.

f. X DC BAL ADJUSTMENT

Allow the instrument to warm up for 15 minutes. Set the X SELECTOR switch at 10 and rotate X AMPLITUDE completely counterclockwise. Loosen the lock nut on the X DC BAL control located on the chassis (See Figure 4-1), and adjust so that there is no change in horizontal position of the "spot" when the X AMPLITUDE control is varied from maximum to minimum. It may be necessary to readjust the X POSITION control on the front panel as adjustments are being made in order to keep the image on the screen. Tighten the lock nut being careful not to disturb the adjustment.

g. (Y) DC BAL ADJUSTMENT

This control, unlike the other factory adjustments, is a screwdriver adjustment accessible at the front panel of the instrument. After about a 15-minute warm-up period, adjust this control so that no change in vertical

position of the trace on the screen results as the Y AMPLITUDE control is varied from maximum to minimum. It may be necessary to adjust the (Y) DC BAL control from time to time to prevent shift of trace when varying the Y AMPLITUDE control.

COMPONENT PARTS LIST
for
WESTERN ELECTRIC KS-15586 OSCILLOSCOPE
(Du Mont Type 2577)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C101	03103500	0.5 uf 600 Volt Paper
C102	03003040	3-12 uuf 500 Volt Var Ceramic
C103	Same as C102	
C104	03033640	6800 uuf 300 Volt $\pm 10\%$ Mica
C105	03029440	1000 uuf 500 Volt $\pm 10\%$ Mica
C106	Same as C102	
C107	03020430	100 uuf 500 Volt $\pm 10\%$ Mica
C108	03002060	0.5 uf 200 Volt $\pm 20\%$ Paper
C110	NOT USED	
C111	03014540	2.2 uuf 500 Volt $\pm 20\%$ Composition
C112	Same as C111	
C113	Same as C111	
C114	Same as C111	
C201	03002020	1 uf 200 Volt Paper
C202	03014810	0.01 uf 600 Volt $\pm 20\%$ Paper
C203	Same as C102	
C204	Same as C107	
C205	03001520	0.25 uf 600 Volt $\pm 25\%$ Paper
C206	Same as C102	
C207	Same as C111	
C208	Same as C111	
C209	Same as C111	
C210	Same as C111	
C301	03004170	0.05 uf 600 Volt Paper
C302-A	03002180	3 x 10 uf 450 Volt Elect.
C302-B	Same as C302-A	
C302-C	Same as C302-A	
C303	Same as C301	
C304	Same as C301	
C305	Same as C301	
C306	03000040	25 uf 50 Volt Elect.
C307	03101590	0.5 uf 400 Volt Paper
C308	Same as C202	
C309	Same as C301	
C310	Same as C104	
C311	Same as C105	

COMPONENT PARTS LIST (CONTINUED)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C312	03020450	150 uuf 500 Volt $\pm 10\%$ Mica
C313	03020940	75 uuf 500 Volt $\pm 5\%$ Mica
C314	03020350	22 uuf 500 Volt $\pm 10\%$ Mica
C315	03016360	0.05 uf 2000 Volt Paper
C401	Same as C201	
C402	Same as C202	
C403	Same as C202	
C404	Same as C202	
C405	Same as C202	
C501	03017750	0.5 uf 2000 Volt Paper
C502	Same as C104	
C503	03029490	2700 uuf 500 Volt $\pm 10\%$ Mica
C504	Same as C501	
C505	Same as C501	
C506	Same as C501	
C507	03012470/3-1247	80 uf 475 Volt Elec.
C508	03003100/3-310	4 uf 600 Volt Paper
CR301	26000630-IN34	Crystal Unit
CR501	Same as CR301	
<u>Fuses</u>		
F501	11000960	1 amp cart
<u>Lamps</u>		
I501	12000840	0.25 amp Inc
<u>Jacks</u>		
J101	09020050	Female 1 Contact
J201	Same as J101	
J401	Same as J101	
J402	Same as J101	
J403	Same as J101	
J404	Same as J101	Male 3 Contact
J501	09004140/9-414	
J502	Same as J501	

COMPONENT PARTS LIST (CONTINUED)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Relay</u>		
K401	05005480	Armature
<u>Inductors</u>		
L101	21003830	17 MH $\pm 5\%$ fixed
L501	21004301	Filter
<u>Resistors</u>		
R101	02041270	2 megohms $\pm 5\%$ 1/2W
R102	Same as R101	
R103	02040550	2000 ohms $\pm 5\%$ 1/2W
R104	02040790	20,000 ohms $\pm 5\%$ 1/2W
R105	Same as R101	
R106	02041050	240,000 ohms $\pm 5\%$ 1/2W
R107	02032170	2.2 megohms $\pm 10\%$ 1/2W
R108	02031760	820 ohms $\pm 10\%$ 1/2W
R109	02031960	39,000 ohms $\pm 10\%$ 1/2W
R110	02034890	10,000 ohms $\pm 10\%$ 1W
R111	02034650	100 ohms $\pm 10\%$ 1W
R112	02031650	100 ohms $\pm 10\%$ 1/2W
R113	Same as R107	
R114	02031690	220 ohms $\pm 10\%$ 1/2W
R115	01009000	100 ohms $\pm 20\%$ 2W var
R116	02030880	47,000 ohms $\pm 5\%$ 1/2W
R117	Same as R116	
R118	01011280	25,000 ohms $\pm 20\%$ 1/2W var
R119	Same as R108	
R120	Same as R112	
R121	Same as R112	
R122	01033300	50,000 ohms $\pm 20\%$ 2W var
R123	01011210	1000 ohms $\pm 20\%$ 1/2W var
R124	02033840	33,000 ohms $\pm 5\%$ 1W
R125	Same as R124	
R126	Same as R122	
R127	02036880	47,000 ohms $\pm 5\%$ 2W
R128	Same as R127	
R129	Same as R127	
R201	Same as R122	
R202	02031830	22,000 ohms $\pm 10\%$ 1/2W
R203	02032070	330,000 ohms $\pm 10\%$ 1/2W
R204	Same as R203	

COMPONENT PARTS LIST (CONTINUED)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Resistors</u>		
R205	01033340	1 megohm $\pm 20\%$ 2W var
R206	Same as R101	
R207	Same as R106	
R208	02032090	470,000 ohms $\pm 10\%$ 1/2W
R209	02032130	1 megohm $\pm 10\%$ 1/2W
R210	Same as R107	
R211	02031860	5600 ohms $\pm 10\%$ 1/2W
R212	01033250	2000 ohms $\pm 20\%$ 2W var
R213	02031850	4700 ohms $\pm 10\%$ 1/2W
R214	Same as R118	
R215	02030430	620 ohms $\pm 5\%$ 1/2W
R216	02031810	2200 ohms $\pm 10\%$ 1/2W
R217	01011030	10,000 ohms $\pm 20\%$ 1/2W var
R218	02031830	3300 ohms $\pm 10\%$ 1/2W
R219	02033800	22,000 ohms $\pm 5\%$ 1W
R220	Same as R219	
R221	Same as R127	
R222	Same as R127	
R223	Same as R122	
R301	Same as R107	
R302	Same as R112	
R303	02032050	220,000 ohms $\pm 10\%$ 1/2W
R304	Same as R107	
R305	02031800	1800 ohms $\pm 10\%$ 1/2W
R306	02031880	8200 ohms $\pm 10\%$ 1/2W
R307	02031910	15,000 ohms $\pm 10\%$ 1/2W
R308	Same as R303	
R309	Same as R305	
R310	01014200	200,000 ohms $\pm 20\%$ 1/2W var
R311	02032010	100,000 ohms $\pm 10\%$ 1/2W var
R312	Same as R307	
R313	Same as R108	
R314	01015340	5 megohms $\pm 20\%$ 2W var
R315	02035090	470,000 ohms $\pm 10\%$ 1W
R316	02038010	100,000 ohms $\pm 10\%$ 2W
R317	Same as R303	
R318	02034910	15,000 ohms $\pm 10\%$ 1W
R319	Same as R316	
R320	Same as R307	
R321	02035010	100,000 ohms $\pm 10\%$ 1W
R401	Same as R123	
R402	02030720	10,000 ohms $\pm 5\%$ 1/2W

COMPONENT PARTS LIST (CONTINUED)

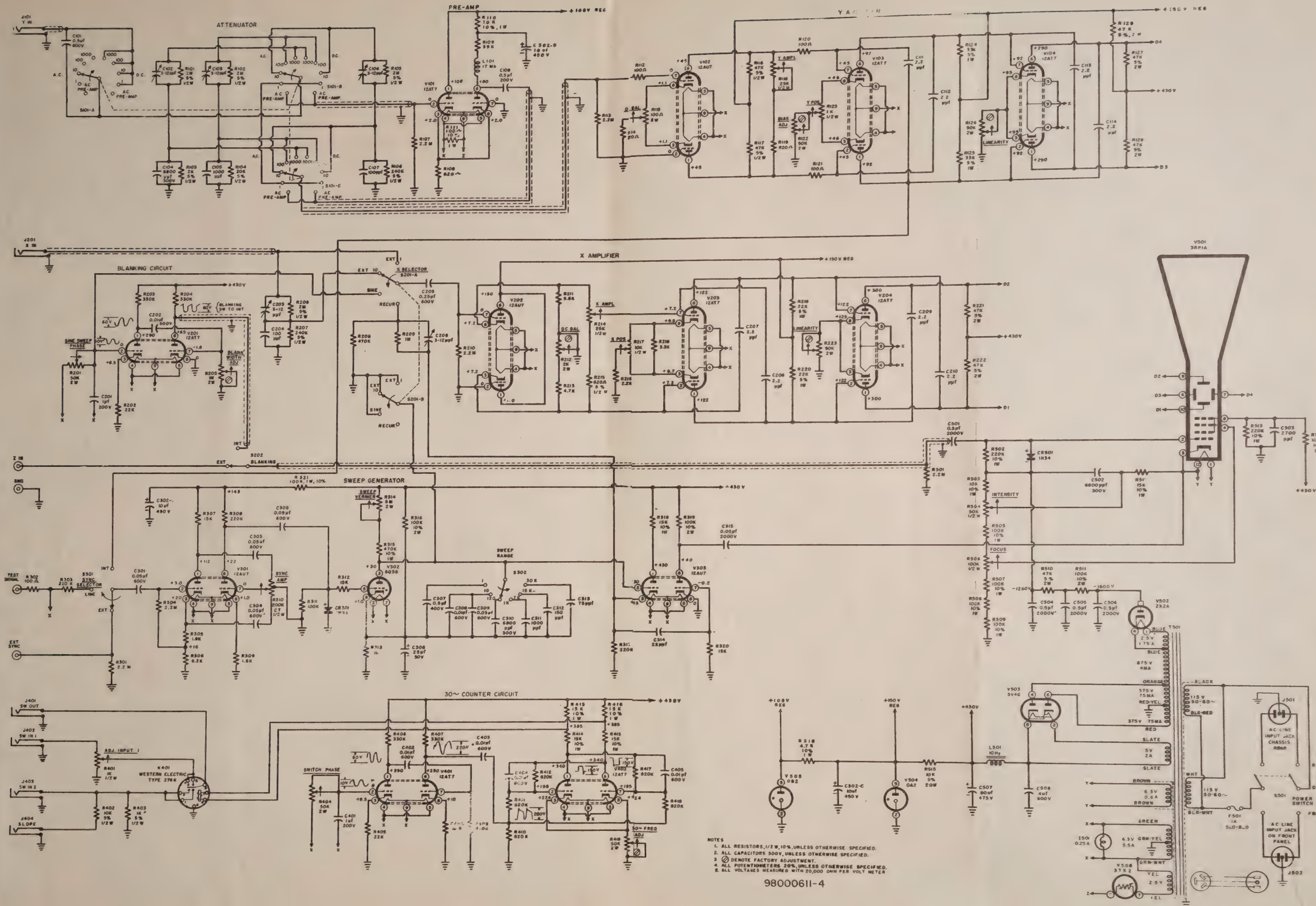
<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Resistors</u>		
R403	02030480	1000 ohms $\pm 5\%$ 1/2W
R404	Same as R122	
R405	Same as R202	
R406	Same as R203	
R407	Same as R203	
R408	Same as R202	
R409	Same as R208	
R410	02032120	820,000 ohms $\pm 10\%$ 1/2W
R411	Same as R410	
R412	Same as R410	
R413	Same as R318	
R414	Same as R318	
R415	Same as R318	
R416	Same as R318	
R417	Same as R410	
R418	Same as R410	
R419	Same as R122	
R501	Same as R107	
R502	02035050	220,000 ohms $\pm 10\%$ 1W
R503	Same as R110	
R504	01008770	50,000 ohms $\pm 20\%$ 1/2W var
R505	Same as R321	
R506	01008780	100,000 ohms $\pm 20\%$ 1/2W var
R507	Same as R321	
R508	Same as R321	
R509	Same as R321	
R510	Same as R127	
R511	Same as R316	
R512	Same as R318	
R513	Same as R502	
R514	Same as R321	
R515	02106800	10,000 ohms $\pm 5\%$ 20W ww
R516	02034850	4700 ohms $\pm 10\%$ 1W

Switches

S101-A	05005301	3P10T Rotary
S101-B	Same as S101-A	
S101-C	Same as S101-A	
S201-A	05005311	2P4T Rotary
S201-B	Same as S201-A	
S202	05000050	1P2T Rotary

COMPONENT PARTS LIST (CONTINUED)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
<u>Switches</u>		
S301	05005321	1P3T Rotary
S302	05005291	1P6T Rotary
S501	05005040	2P2T Toggle
<u>Transformer</u>		
T501	20004232	Power
<u>Tubes</u>		
V101	25001530	12AT7
V102	25000130	12AU7
V103	Same as V101	
V104	Same as V101	
V201	Same as V101	
V202	Same as V102	
V203	Same as V101	
V204	Same as V101	
V301	Same as V102	
V302	25000640	6Q5G
V303	Same as V102	
V401	Same as V101	
V402	Same as V101	
V501	25001800	3RP1A
V502	25000490	2X2A
V503	25000160	5V4G
V504	25000300	OA2
V505	25000360	OB2
V506	02150010	3TK2



WARRANTY AND SERVICE NOTICE

for

Industrial Type Cathode-ray Tubes and Instruments

DU MONT INSTRUMENTS

Each instrument manufactured by the Instrument Division of Allen B. Du Mont Laboratories, Inc., is guaranteed to equal or exceed its published performance specifications. It is further guaranteed against defective materials (other than the cathode-ray tube) and workmanship for a period of one year from date of delivery. Any defective instrument or an instrument that does not meet or exceed our specifications will, upon inspection by us, be repaired or replaced at our discretion should such defect appear within the guarantee period.

To register this guarantee, the enclosed guarantee card must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. **BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.**

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

DU MONT CATHODE-RAY TUBES

Industrial type cathode-ray tubes manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed for 1000 hours of operation or for a six-month period of installation, whichever shall first expire. The right is reserved, however, to limit claims to a period of nine months after shipment from the factory. Adjustments will be made on the merit of each individual claim because of the widely varying applications to which such tubes are subjected, and a tube which becomes defective during the guarantee period will be replaced **ONLY AFTER INSPECTION AT THE FACTORY.** Cathode-ray tubes which are sent in under the guarantee, must be sent with transportation paid.

BURNED OUT HEATERS AND BROKEN GLASS ARE NOT COVERED BY THE TUBE GUARANTEE

To register a tube guarantee, the guarantee card enclosed with the tube must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. **TYPE NUMBER AND SERIAL NUMBER OF THE CATHODE-RAY TUBE MUST BE IN-**

CLUDED. The serial number of the tube will be found either on the glass stem of the electron-gun structure or on the bulb near the Du Mont brand. Tubes must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure factory service under our guarantees, the guarantee cards enclosed with all instruments and tubes must be properly filled out and returned. In all cases where service or adjustment is requested, please write first to the factory giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. **THE TYPE NUMBER AND SERIAL NUMBER** of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing in this respect, address:

Allen B. Du Mont Laboratories, Inc.
Instrument Service Department
1500 Main Avenue, Clifton, New Jersey

The Instrument Service Department will then send to the customer, the written procedure for sending the instrument back to the factory. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the type number and serial number of the instrument and refer to the component by its symbol designation and description on the circuit schematic. This will help to expedite service.

PATENT NOTICE

Manufactured under one or more of the following U. S. Patents:

1,960,333	2,000,014	2,014,106	2,067,382	2,082,327
2,085,576	2,098,231	2,153,800	2,157,749	2,162,009
2,163,256	2,185,705	2,186,634	2,186,635	2,190,020
RE. 21,326	2,207,048	2,208,254	2,209,507	2,221,398
2,225,099	2,227,822	2,245,409	2,245,428	2,249,942
2,249,943	2,269,115	2,280,700	2,280,738	2,290,592
2,297,742	2,297,752	2,299,510	2,315,848	2,319,691
2,321,149	2,328,259	2,337,980	2,338,336	2,338,646
2,343,630	2,345,549	2,347,933	2,355,363	2,356,733
2,364,687	2,365,476	2,372,901	2,373,114	2,379,488
2,384,931	2,389,025	2,391,090	2,391,273	DES. 143,796
2,396,014	2,398,535	2,404,185	2,408,193	2,409,419
2,410,920	2,414,319	2,419,118	2,419,177	2,421,248
2,423,362	2,426,419	2,435,564	2,435,680	2,436,265
2,437,173	2,438,668	2,438,717	2,439,186	2,440,597
2,441,334	2,442,138	2,442,545	2,443,864	2,444,560
2,444,572	2,445,933	2,445,964	2,446,214	2,448,762
2,448,771	2,448,794	2,448,814	2,451,590	2,455,992
2,456,016	2,457,722	2,472,889	2,473,700	2,473,718
2,477,384	2,481,617	2,483,452	2,483,457	2,483,471
2,484,107	2,485,310	2,488,132	2,490,812	2,496,102

Other Patents Pending

ALLEN B. DU MONT LABORATORIES, INC.

CLIFTON, N.J., U.S.A.

